REMARKS

Claims 1-4 and 9-24 are in this application and are presented for consideration. By this Amendment, Applicant has amended claims 1, 2, 3, 10 and 12. Claims 5-8 have been canceled. Applicant has added new claims 18-24.

Claims 1-17 have been rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention.

Applicant has amended the claims paying close attention to the Examiner's comments. Applicant would like to thank the Examiner for the careful review of the claims. It is Applicant's position that the claims as now presented are clear and satisfy the requirements of the statute.

Claims 1, 4, 9 and 11 have been rejected under 35 U.S.C. 102(b) as being anticipated by Brewer et al. (US 6,322,600).

The present invention relates to a method for polishing a wafer. Applicant has discovered that conventional techniques of wafer polishing result in linear defects on the surface of the polished wafer. The present invention advantageously solves this problem by providing a method for polishing a wafer such that linear defects are not generated on the wafer. Applicant has found that supplying a polishing agent containing an alkaline solution containing an organic base or a salt thereof and silica having essentially spherical particles advantageously reduces linear defects. The silica has particles in which each particle is essentially in the shape of a sphere and has an average particle diameter of 5 to 10 nm. The particle diameter of the

silica particles is significant in the present invention because such conditions advantageously reduce the linear defects that are generated on the surface of the wafer. The pH of the alkaline solution is controlled in a pH value range from 10 to 13. Sodium carbonate is used for the pH adjustment of the alkaline solution during polishing. The pH value range and the use of sodium carbonate is critical in the present invention because these conditions advantageously lead to an increase of the polishing rate as well as stabilizes the polishing rate. The use of sodium carbonate advantageously provides for easy adjustment of the pH level while being easy to handle throughout the polishing process. The prior art as a whole fail to disclose such features or advantages.

Brewer et al. discloses a planarization composition for chemical mechanical planarization of dielectric layers for semiconductor manufacture. The composition comprises spherical silica particles having an average diameter from 30 nm to 400 nm. Ninety percent (90%) of the particles is within 20% of the average particle diameter. The composition includes a liquid carrier comprising 9% alcohol and an amine hydroxide in the amount of 0.2 to 9% by weight. The pH of the composition is in the range of 9 to 11.5 and the remainder of the solution is water. The composition has low amounts of metal ions. The composition is used for thinning, polishing and planarizing interlayer dielectric thin films, shallow trench isolation structures and isolation of gate structures.

Brewer et al. fails to teach and fails to suggest the combination of controlling the pH level between a pH value range of 10 to 13, wherein sodium carbonate is used for the pH adjustment. At most, Brewer et al. discloses a composition having a liquid carrier containing

9% alcohol and an amine hydroxide in which the pH of the composition is 9 to 11.5. However, Brewer et al. does not disclose the specific pH range of 10 to 13. Controlling the pH in the range from 10 to 13 is critical in the present invention. Applicant has discovered that such a pH range advantageously leads to an increase of the polishing rate and to an increase of the stability of polishing rate. Applicant has also found that such a pH range advantageously reduces linear defects on the wafer. Further, Brewer et al. fails to disclose using sodium carbonate for the pH adjustment. At most, Brewer et al. discloses using acids such as acetic acid, nitric acid, citric acid, hydrochloric acid, carboxylic acid, acetylsalicylic acid and sulfuric acid to adjust the pH level. In contrast to Brewer et al., the present invention uses sodium carbonate to adjust the pH level. Sodium carbonate is advantageously easy to handle during the polishing process and provides for quick adjustment of the pH level in the present invention. Using sodium carbonate to control the pH in the range from 10 to 13 advantageously prevents generation of linear defects on the wafer and provides a mirror polished wafer that has an excellent surface. Brewer et al. fails to provide such advantages since Brewer et al. fails to teach the specific pH range as claimed and fails to suggest using sodium carbonate to adjust the pH in the range from 10 to 13. As such, the prior art as a whole takes a different approach and fails to suggest the features of the claimed combination. Accordingly, Applicant respectfully requests that the Examiner favorably consider claim 1 and all claims that depend thereon.

Brewer et al. fails to teach and fails to suggest the combination of an alkaline solution containing silica wherein each silica particle has an average particle diameter of 5 to 10 nm. At most, Brewer et al. merely suggests spherical silica particles having an average diameter from

30 nm. to 400 nm. In contrast to Brewer et al., the silica particles of the present invention each have an average diameter of 5 to 10 nm. The particle diameter of the silica particles is significant in the present invention because it significantly reduces the linear defects that are generated on the wafer surface and advantageously provides for an excellent mirror polished wafer surface that is free of defects. Brewer et al. fails to provide such a defect-free wafer surface since Brewer et al. does not disclose the silica particle diameter as claimed. Accordingly, Applicant respectfully requests that the Examiner favorably consider claim 2 and all claims that respectively depend thereon.

Claims 7, 10 and 14-17 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Brewer et al.

To the best of Applicant's knowledge, the subject matter of the various claims was commonly owned at the time any inventions covered therein were made.

As previously discussed above, Brewer et al. fails to teach or suggest silica particles having the claimed particle diameter range. As also discussed above, Brewer et al. does not disclose the specific pH range wherein sodium carbonate is used to control the pH level in the range from 10 to 13 as claimed. Further, Brewer et al. provides absolutely no suggestion of using silica at a concentration in the range of from 2 to 20 wt % or a woven cloth having a specific hardness as claimed. These features are essential to the present invention and advantageously reduce the linear defects on the wafer during the polishing method. The reference must provide some teaching or suggestion of the features of the claimed combination. However, Brewer et al. fails to direct one of ordinary skill in the art towards the features of the

present invention, particularly the polishing parameters as claimed. As such, the reference does not suggest the combination of features claimed. One of ordinary skill in the art is presented with various concepts, but these concepts do not provide any direction as to combining the features claimed. All claims define over the prior art as a whole.

New claims 18-24 have been added. New independent claim 18 highlights the recirculating feature of the present invention in which the excess polishing agent is collected and recirculated. After the polishing agent is collected, the pH of the polishing agent is adjusted before being supplied again to the wafer. This advantageously allows the polishing agent to be reduced so that costs of polishing the wafer is reduced. Claims 19-24 are based on claim 18 and further clarify the features of claim 18. Applicant respectfully requests that the Examiner favorably consider new claims 18-24 as presented.

Favorable action on the merits is respectfully requested.

Respectfully submitted
for Applicant,

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